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ROCK DUST SPREADING SYSTEM

Background Of The Invention

This application claims priority under 35 U.S.C. 119(e)(1) based on Applicants Provisional U.S. Patent Application Serial No. 60/421,713 filed 10-28-02 and titled "TRICKLE DUSTER SYSTEM".

Field: This invention concerns a rock dusting system for use in coal mines, and particularly concerns such a device which can more effectively provide the rock dust, e.g., limestone dust, as non-agglomerated fines to the mine ventilation air currents for transportation thereby over substantial distances.

In underground coal mines, large amounts of coal dust are necessarily generated by the cutting, blasting, loading, crushing and the like of the coal particularly proximate the mining (working) faces. This dust not only is present in air borne high concentrations at these sites but is carried by the mine ventilation air currents from these sites, as well as from belt conveyor transfer points and locations along the belt conveyor where ventilation checks are installed, throughout the mines until it settles out on down stream surfaces. Such atmospheric dust and settled-out dust accumulations are fire and explosion hazards and must be periodically cleaned up or made inert by the addition of limestone rock dust.

Prior Art: Underground coal mines are required to spread limestone dust within the mine to lessen coal dust explosion hazards. If enough limestone dust is mixed with the coal dust, then the mixture is inert and will not explode.

One way to "rock dust", i.e., mix limestone dust with coal dust at the ventilation air return entries generally designated 19 is to use a "Trickle Duster". Trickle Dusters utilize a blower, usually a lobe type, which blows air through a container of limestone dust and ejects a continuous small amount of dust out into the return entries air stream. Such trickle dusters are exemplified by that described in U.S. Patent 4,872,598, the disclosure of which is hereby incorporated herein by reference in its entirety.

One problem associated with the Trickle Duster, or any other dust container thru which air is blown to discharge the dust, is that in the summer when outside air is hotter and the humidity is higher than within the mine, this ventilation outside air is taken underground and cooled causing water to condense from the air. This 100% humidity air is what is blown through conventional dusting apparatus, particularly Trickle Dusters causing the limestone dust to become wet. Consequently, the limestone dust that is emitted from the Trickle Duster is not only wet but is agglomerated into heavy clumps which fall out of the return entry air stream faster than desired which results in the presence of a lot of limestone dust downstream of the Trickle Duster for only a short distance, but very little from there on. This situation is made more dangerous since explosive coal dust typically travels farther than the limestone dust.

Summary Of The Invention

The present invention concerns a rock dust spreading system and method which is employed to discharge limestone rock dust into the

ventilation air currents of mines, particularly at locations where the ventilation air enters the returns (24) and is defined structurally as a system for dispersing dust material into the atmosphere in an underground coal mine having an air ventilation pattern wherein fresh air is pumped from outside of the mine into the mine thru fresh air passageways leading to the mine work faces and wherein the contaminated air is forced out of the mine thru return contaminated air passageways, said system comprising tank means, ventilation air feed means communicating with said tank means, air-dust mixture discharge port means in said tank means, and dehumidifier means communicating with said air feed means for maintaining the feed air at a humidity level sufficiently low to prevent rock dust in said tank means from agglomerating.

This system allows the limestone dust to travel farther in the return entries and employs an air compressor to generate, for example, 75 psi air with 2 cfm of volume. At this pressure a membrane air dryer gives about a 40° F dew point feed air. Since the ambient temperature in most underground mines is about 55° F, this feed air actually further dries the limestone dust.

By using this system, the limestone dust will travel farther in the return entries making the coal dust inert, thereby decreasing the potential for coal dust explosions.

Brief Description Of The Drawings

The invention and its objects will be understood further from the following description and drawings herein wherein:

FIG. 1 is a top down cross-sectional, schematic of the ventilation air flow pattern in a typical underground coal mine; and

FIG. 2 is a block diagram of the present system.

Detailed Description

Referring to Fig. 1, the coal mine is depicted as a main shaft 10 of a length, e.g., one mile and having an entry 12 and working faces 14 of a coal seam generally designated 16. The unmined pillars of coal 18 support the mine ceiling and cinder blocks or other air flow barriers 20 between the inner rows of pillars provide the fresh air inlet or intake passage 22 which feeds the fresh air to the locations of the faces 14, and of course, the miners. The return contaminated air flow returns are indicated by arrows 24.

A typical air flow rate, both intake and return is about 4,000 to about 10,000 CFM. Coal dust is generated in the working face areas and is carried by the return air stream to returns 24 where some of the coal dust is dropped out of the return air stream, making return entries black with float dust.

The air compressor is conveniently powered, for example, by a ten horse power electric motor. A piston type compressor is driven by the electric motor by means of sheaves and V-belts in known manner, and forces air through the dryer and then thru the pressure regulator and then thru the container holding the finely comminuted limestone rock particles. When employing the trickle duster of the aforementioned patent, outlet port 6 at the top of the tank allows the air to escape, carrying the limestone rock dust with it at a slow, even rate and allows only the finely comminuted solids to emit into the ventilation air current.

Referring to Fig. 2, the numbered structures are:

1. Intake Air Filter such as a standard air compressor air filter;
2. Air Compressor, preferably piston type;

3. Membrane Dryer; When high humidity air is forced thru the dryer membrane air can go thru the membrane but water is of a larger particle size and cannot go thru the membrane;
4. Pressure Regulator which keeps enough pressure on the membrane dryer so it can operate, e.g., 60 psi intake air;
5. Rock dust Container, Preferably a Trickle Duster. Also of use are other rock dust containers such as reinforced plastic bags. These bags can hold several tons of limestone dust and will be set in return entries. The dried air will enter the bag at the bottom and a hole will be cut in the bag at the top so the air and dust can be discharged out this hole.
6. Discharged or Emitted Limestone Dust and Air.

This invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications will be effected within the spirit and scope of the invention.